IDIOPATHIC OSTEOPSATHYROSIS (FRAGILITAS OSSIUM) IN INFANCY AND CHILDHOOD.

By J. P. Crozer Griffith, M.D.,

CLINICAL PROFESSOR OF DISEASES OF CHILDREN IN THE UNIVERSITY OF PENNSYLVANIA;
PROFESSOR OF CLINICAL MEDICINE IN THE PHILADELPHIA POLYCLINIC.

Except in old persons fragilitas ossium, or osteopsathyrosis, as it was first called by Lobstein (*Traité d'Anatom. Patholog.*, 1833, T. ii. 204), is a condition comparatively so uncommon that it receives but little attention from most writers of text-books, and that instances of it are always of interest. Even special articles of value upon the subject are few in number. The most exhaustive and satisfactory is the classical contribution by Gurlt (*Handbuch der Knochenbrüche*, 1862, Theil. i. 147), which contains a number of cases cited from medical literature. Among other writers Volkmann (Pitha-Billroth; *Handb. d. allg. u. spec. Chirurg.*, 1865, B. ii., Abt. ii., Hlft. i. 365) gives a short but very useful review of the subject. Enderlen (*Arch. f. pathol. Anat.*, 1893, cxxxi. 223) collects a few cases additional to those of Gurlt, and the article by Linck (*Arch. f. Gynäkol.*, 1887, xxx. 264) is of value. More recently Schultze (*Arch. f. klin Chirurg.*, 1894, xlvii. 327) and Moreau (*Contribution a l'étude de la fragilité des os.* Paris, 1894) have written regarding it, limiting themselves largely to the idiopathic form. Simon (*Des fractures spontanées*, Paris, 1886) and Dubrueil (*Étude critique sur les fractures spontanées*, Paris, 1891) have discussed it in theses upon spontaneous fractures.

Several varieties of osteopsathyrosis may be distinguished. Thus we may have it either symptomatic to other affections or occurring idiopathically—*i. e.*, not associated with any discoverable cause. The symptomatic form depends upon various conditions. For instance, rhachitis is capable in many instances of occasioning actual transverse fracture, as well as great bending of the bones. Osteomalacia likewise may produce fractures, and sometimes to such an extent that an *osteomalacia fracturosa* (Kilian) has been described. Cases of fragilitas due to scurvy have also been reported, and it is possible that some of the instances of brittle bones in infants may be attributable to it. Syphilis has long been considered a cause of osteopsathyrosis. It is a disputed point whether congenital syphilis may occasion a general brittleness of the whole of the osseous system, depending upon some unrecognizable change in the structure of the bone, or whether the fractures are always the result of localized gummatous processes. The studies of cases by Gangolphe (*Malad. infec. et parasit. des os*, 1894) failed to show any instances of fragility of bone in congenital syphilis independent of local lesions, and Volkmann believes that syphilitic fractures are the result of a gummatous osteitis. There certainly seem to be good grounds for believing that at least most of the cases of fragilitas attributed to the general effect of syphilis are so attributed without good reason. Simon believes that both hereditary syphilis and scorbutus are more apt to occasion separation of the epiphyses.

There are, further, a whole series of causes which probably produce atrophy of the bone and consequent fragility. Many of these are of a distinctly nervous nature. Thus we find fragility sometimes developing in locomotor ataxia, poliomyelitis, and mental diseases. There are also atrophic changes resulting from simple inactivity, and those commonly attending old age. There is some question, however, whether the fractures which so often and so easily occur in old persons depend always on fragilitis, or whether they are not in many cases brought about by the diminished power old persons have of guarding themselves against falls and other accidents capable of producing fractures.

Finally, there is a series of local causes for fragilitas, among them osteomyelitis, carcinoma or other malignant growth of the bone, gummata, echinococcus or other cysts, and localized necrosis.

It is, however, only with idiopathic osteopsathyrosis that we have to do in this connection, and, to narrow it still more, only with those cases in which the disease begins in infancy or childhood. The following case is a remarkable instance of the very early, almost congenital presence of the disease. I saw the child with Dr. B. H. Detwiler, of Williamsport, Pa., to whom I am indebted for the facts of the clinical history:

H. E., male, aged two years and ten months. The family history is good, both parents and grandparents being unusually healthy people. The only exception is that a brother of the mother had never been able to walk, and died at the age of six years. His affection, however, seems to have been rather a mental one than any involvement of the bones. A brother of the patient died when five months old, apparently through the effect of heat. The patient, who is the second and only other child, was born July 11, 1893. Labor was not protracted nor severe. Nothing unusual was noticed until the second day after birth, when it was found that the right femur was fractured, and, on further examination under an anæsthetic, the left femur was also found to be broken in its neck. Both limbs were placed in long splints and dressed with a silicate of soda bandage. In three weeks the dressings were removed and union was found complete. On September 11th, at the age of three months, the right humerus and right femur were broken. The accident appears to have been the result of a medical examination, since the boy cried as though in pain while it was going on. As the examination was made with due gentleness this shows the exceeding brittleness of the bones. Both bones united nicely. On March 1, 1894, he was sitting in his chair, lost his balance and fell forward, but not out of the chair, producing a fracture of the right femur near the hip. On September 11, 1894, just a year after the former accident, he broke his left thigh again. Union took place, but in October, two weeks after the dressings had been removed, the bone was fractured again. This time it was kept in splints four or five weeks. When examined during anæsthesia the femora appeared to be abnormally thin. In the spring of 1895 he fell out of his hammock and broke both his thighs. Union took place well. Three months later he broke his right thigh.

Besides these fractures there were times when he appeared to be having pain in various parts of the body, supposed to be rheumatic, but which was undoubtedly due to undiscovered fractures, since at least one fracture of the left thigh and one of the right forearm, both of which united with angular union, were found afterward. On several occasions he has broken his ribs. It is estimated that he has had in all 17 or 18 fractures, and he certainly has had 12. The fractures have always been attended by pain, but do not appear to have been preceded by it. Union has always been prompt. The child was nursed until the age of five months. After that he was fed with cow's milk and later with nourishment suitable to his age. The general health and nutrition are good. The appetite is good, and there have been but slight digestive disturbances. He is carried constantly upon a stretcher, lest sitting him up should produce fracture.

I saw him for the first time December 3, 1895. Examination was difficult, owing to the great terror which the child had of doctors, and the danger of fracture which handling entailed. He was a plump, apparently well-developed and healthy-looking boy, lying comfortably on his back on a stretcher. The head was decidedly larger than normal. The frontal bones had distinct bosses suggesting rickets, and the back of the head was flattened, doubtless from the long-continued pressure caused by the enforced position. There were no other evidences of possible rickets connected with it. The chest was of normal shape and there was no beading of the ribs. There were no enlargements of the epiphyses of the long bones. The right arm had a bad angular deformity shortly above the wrist, and the left thigh was similarly deformed at the upper third, with eversion of the foot. Curvature of the bones in any part of the body could not be detected. The muscles of the calves were well developed, but the thighs were flabby. The arms were well developed. He had been taking cod-liver oil for some time. I advised that he be carefully accustomed to sit up in order to give his muscles the needed exercise.

I saw him for the second time in April, 1896. He had improved greatly. He could now turn himself over and move his legs freely, and could sit upright in the lap, although he needed support. The muscles were evidently gaining strength rapidly. His general condition was excellent. His head, however, seemed even larger than at the first examination, although not hydrocephalic in appearance nor of rickety shape. It seemed, in fact, simply to be an unusually large head for his size. There had now been no fractures since the preceding summer, and the fragility seemed evidently less. I advised the use of phosphorus in addition to the cod-liver oil, and that he have plenty of fresh air and all the exercise he could be made to take with safety to his limbs. I could not obtain a specimen of urine.

I have looked somewhat extensively through medical literature in search of cases of idiopathic osteopsathyrosis in childhood, in the effort to learn what light the experience of others might throw upon the cause, nature, and treatment of this strange affection. There have been but few cases reported with a degree of brittleness greater than, or even as great as, that shown by the case just detailed; and even instances with a less, although still decided, brittleness, with the occurrence of multiple fractures, have not been common. The list which follows is the result of the search. Cases have been excluded in which the disease appeared to have commenced after puberty, and most of those also in which but one or two bones were fractured apparently from slight causes. Those cases, too, have been omitted in which it seemed certain from the other symptoms or from the post-mortem examination that the undoubted fragility was secondary to some other disease. Instances of multiple intrauterine fracture, in which it seemed likely that accidents happening during pregnancy were sufficient to account for the lesions, have also been rejected. On the other hand, a number of doubtful cases have been included, although with explanatory remarks to indicate the uncertainty. The observations are not arranged in any alphabetical or chronological order.

A. CASES SHOWING DIRECT INHERITANCE.

The influence of inheritance has been very marked in a number of instances, the disease having appeared in the parents or grandparents, and perhaps affecting several children of the family. The following cases represent this direct inheritance:

I. Greenish (*Brit. Med. Journ.*, 1880, i. 967). In a family the grandfather, A., had been an invalid on account of multiple fractures. He had three sons and two daughters. The daughters and one son had no fractures, but of the remaining two sons one, B., had suffered 1 fracture, and of his children one son had 13 fractures by the age of nineteen years, the first break occurring when very young. Most of the fractures healed promptly, but some were very slow. Another son had 2 fractures, the result of a severe accident. One other son and two daughters escaped accident. A.'s other son, C., had 2 fractures, and of his children one son had 8 fractures, one son 3, three sons each 4, and one daughter 3 fractures. Four other daughters escaped accident. The cause of the fractures was usually slight.

II. Pauli (*Unters. u. Erfahrung. im Gebiete der Chir.*, 1844, 35. Quoted in *Dublin Hosp. Gaz.*, February 1, 1846, 189). The members of a family otherwise healthy had all had fractures; three of them had 2 each, one 3, and one 5 fractures. No considerable violence was required. No fracture occurred before the age of eight years. All healed with unusual rapidity. A second break never took place in the seat of a former one. Both the father and grandfather had been liable to fractures.

III. Willard (*Med. News*, 1887, ii. 734). The father and mother showed no evidence of syphilis and denied having had it. The children were small, puny, and had notched teeth, and some were almost dwarfs.

The father had 3 fractures, all from direct violence. One daughter, eighteen years old, had 9 fractures by the age of twelve years, the first occurring at twelve months. One daughter had 5 fractures by the age of sixteen years, the first at four years. One daughter, aged eighteen years, had 3 fractures by the age of twenty-two months, but none since. The first was at eight weeks. One son had 4 fractures by the age of eight years, the first being at two years. One daughter fractured her left clavicle at birth, during an easy labor, and fractured it again at thirteen months. One daughter fractured her right clavicle at the age of one week. One daughter fractured her left clavicle at the age of three weeeks. One son fractured a rib at seven years of age. A grandchild, the child of one of the affected daughters, broke its thigh at the age of four weeks, and broke it again at nine months.

Nearly always the fractures resulted from some insignificant cause. Union was usually speedy. In the femora the fractures were nearly always in the line of the callus.

In this case the presence of fragility in the father is doubtful, but its inheritance by the grandchild is undoubted.

The following instance of fragility is so interesting on account of the remarkable inheritance that I include it, although there is strong doubt upon the propriety of calling the osteopsathyrosis idiopathic:

IV. Ekmann (*Dissertatio medica descriptionem et casus aliquot osteomalaciæ sistens.* Upsaliæ, 1788. Quoted by Gurlt, *loc. cit.*, 148). The great-grandfather, A., had limbs so deformed that he could not walk. In the next generation one son, B.$_1$, lost all strength in the arms and legs at the time of puberty. One daughter, B.$_2$, was small and deformed and waddled. One son, B.$_3$, was a dwarf and had a decided bend of the arms and legs. In the third generation—the children of B.$_3$—there was one son, C., who experienced fractures from the slightest causes from earliest infancy. His limbs were bent and he was unable to walk. In the fourth generation—the children of C.—one son, D.$_1$, when scarcely a month old, had his arms and legs so soft that they bent with the slightest touch, and later fractured three or four times in every year of his childhood. One daughter, D.$_2$, had a fracture when eight days old, without the action of any discoverable force, and later, during childhood, suffered fractures from the slightest causes.

It would seem that the ancestor of this family was deformed, but whether from bending or breaking is not stated. The next generation showed softening of bone apparently without fracture. The next showed remarkable fragility which seemed far to exceed the softening. The last generation exhibited great softening with fragility in one case, and seemingly fragility alone in the otner.

V. Goddard (personal communication to Gibson. *Instit. and Pract. of Surgery*, 1850, 8th ed., i. 236). A boy of thirteen years had 14 fractures, all from very slight causes, and all healing promptly. Four of them occurred by the age of four years. His mother had had 6 fractures and her brother 13 (11 in thighs and 2 in arms) up to the age of thirteen years.

VI. Hamilton (case reported by Armenag Assadoorian). (*Physician and Pharmacist*, February, 1870.) A man of fifty-three years broke the left elbow when a child, and two years later the right elbow. No union took place. Some time later he broke the left clavicle. In all he had 11 fractures and 2 dislocations. With regard to one accident it is stated that union was slow. His father broke both forearms at the elbow. Two paternal uncles each broke a leg and one of them an arm. A sister had one fracture, and she or another sister had another. A brother had 5 fractures and 1 dislocation.

VII. Graham (*Boston Med. and Surg. Journ.*, 1884, cx. 467). A man [it would seem of thirty-two or thirty-three years of age] had his first fracture at eighteen months. He continued to have them at frequent intervals, and had in all 18 fractures by the age of eighteen years, but none since. His father had 14 fractures, and a cousin of his father 21. The father's paternal uncle also was a bone-breaker.

VIII. Cox (*Eclect. Med. Journ.*, Cincinnati, 1879, xxxix. 458). A girl of eighteen years had never been able to walk [presumably from early fractures]. Her lower extremities were greatly deformed and she had in all 7 fractures, 5 of them of the femur. The brother of thirteen years had never been able to walk [but it is not stated whether there had been fractures]. The father and several of his brothers had bones easily broken.

IX. Hiester (*Boston Med. and Surg. Journ.*, 1849, xli. 393). A well-developed girl of sixteen years fractured her leg in going upstairs. This was her 3d fracture. [The age when the others occurred is not stated.] Three other children of the family had 8, 7, and 3 fractures, respectively. The maternal grandfather had 4 or 5 fractures.

X. Battles (personal communication to Gross. *System of Surgery*, 1882, 6th ed., vol. i. 871). Of eleven children five, all males, had fragility of the bones. One of them, aged twenty-four years, had 64 fractures; the next had 34; the third child, aged thirteen years, had 30; the fourth, aged eleven years, had 10; the fifth, aged two years, had 2. All were situated in the thighs, occurred usually from slight causes, and united promptly. No severe pain was experienced. The six daughters resembled the father in appearance, but the five sons looked like the mother, through whom the fragility seemed to be inherited; her father and several of her brothers and sisters had brittleness of the bones.

The following instance is a doubtful one, since the "fractures" may have been but separations of the epiphyses:

XI. Atherton (*Dominion Med. Monthly*, 1894, ii. 1). A boy of thirteen years fractured his olecranon twice on each side, making 4 fractures in all. There was a tendency in the family to fractures from slight causes. The paternal grandfather had 3 or 4 fractures, and the paternal grandmother very frequent fractures. The father had at least 6 fractures, and the paternal uncles had broken their bones. The patient had two sisters, both of whom escaped.

B. CASES SHOWING A FAMILY PREDISPOSITION.

There are other cases than those detailed in which no direct inheritance is reported, yet in which there is a striking family history, more than one child being the subject of the disease, or perhaps other relatives suffering from it. The cases of this nature which I have been able to find are as follows:

XII. Pritchard (*Lancet*, 1883, ii. 394). A male child, apparently healthy, fractured both humerus and femur without history of accident two days after birth; on the next day broke the other humerus through being moved in bed; and in three weeks broke the other femur. All united promptly. The father was one of eight children, two of whom had fractures in infancy. The only brother of the father had four children, three of whom had fractures apparently spontaneously soon after birth.

The case reported by Pritchard shows a remarkable degree of indirect inheritance. It is not stated that the fathers themselves suffered fractures.

XIII. Axmann (*Ann. f. d. ges. Heilk.*, 1831, iv. 58. Quoted by Gurlt, *loc. cit.*, 149). The writer gives his own family history. He and his two brothers were of rather delicate build. He had a fracture of the leg in his third year; one brother had 4 fractures from the age of two to that of nineteen years, 3 of them occurring before six years of age. The other brother had 9 fractures from the age of two to that of nineteen years, 4 of them before he was five years old. These 14 fractures occurred without the action of noteworthy force. All healed in four or five weeks. The fragility decreased with growth and disappeared at maturity.

This case is doubtless the same as that referred to by Lobstein (*loc. cit.*) and reported by Strack (*Neues Journ. d. pract. Arzneyk. u. Wundarzneyk.*, 1806, xxv., 3 St., 163), and, according to Gurlt, is probably the same as that described by Renard (*Versuch ü. die Entstehüng u. Ernährung des Knochen*, Leipzig, 1803). I have not been able to obtain the original. It seems very possibly, too, identical with that reported by Mebes, and presently to be detailed (XVIII.).

XIV. Arnott (*London Med. Gazette*, 1833, xii. 366). A girl of fourteen years, a patient at the Middlesex Hospital, suffered her first fracture at the age of three years, and had in all 31 fractures, viz, thighs 13, legs 10, arms 7, forearm 1. Slight falls, or even turning around suddenly, were sufficient to cause them. Union was always complete and remarkably prompt. A sister of six years had 9 fractures, the first at eight months. The general health of both girls was excellent. Two brothers and one sister were unaffected.

XV. Agnew (*Princip. and Pract. of Surgery*, 1878, vol. i. 918). A child of three years with a fracture of the thigh had broken the same bone the year before. Five other children in the family had each had fractures of some part of the skeleton, two of them each 3 times, and one, an infant of three weeks, having had a rib broken by being turned in the nurse's arms. The author believes that a syphilitic taint in the father was the cause of the fragility. [However, no evidences of the existence of syphilis in the children are mentioned.]

XVI. Moreau (*Contribution a l'étude de la fragilité constitutionelle des os.* Thèse de Paris, 1894). A girl, aged twelve years, broke her leg at the age of five years, and had 7 fractures within four years and ten months. All but one were in the legs. Her sister, aged nine years, broke her leg at the age of five years, and had 10 fractures within two years and eight months. All but two were in the legs. All the fractures in these two cases were produced by insignificant causes and all healed promptly. The children were apparently healthy, without history of syphilis or rickets. The father died of progressive paralysis. The mother had by her first husband two children unaffected by the disease.

XVII. Jones (*Medical Archives*, St. Louis, 1866, iii. 127). A man of twenty-four years, of excellent general health. At the age of three years he broke both legs as the result of a slight fall. Since then there had been numerous fractures, about 50 in all, chiefly in the lower extremities. The slightest fall would be sufficient to cause them. Little pain attended and union was rapid. Great deformity finally resulted, making the patient unable to walk. A cousin, the niece of his father, had been afflicted in a similar manner, and had numerous fractures.

XVIII. Mebes (*Die Knochenbrüche, etc.*, 1845, 35). This writer states that among other instances of the affection he knows of a family in which three children had broken legs and arms 8 times within five years.

This brief note corresponds so closely in the number of cases and in the age with the account given by Strack (*loc. cit.*) of the early history of the Axmann family (see XIII.), that it seems very possible that the cases are identical.

C. ISOLATED CASES.

There are a considerable number of cases reported in which no history is given of inheritance of the malady or of family predisposition. I have been able to find the following instances:

XIX. Blanchard (*Chicago Med. Journ. and Exam.*, 1876, xxxiii. 7). Later and more completely in *Transac. Amer. Orthop. Assoc.*, 1893, vi. 83). A woman, aged twenty-seven years, experienced her first fracture at the age of two months. Up to the age of nine years, when first reported, she had 41 fractures. At twenty-seven years she was unable to walk and had about 106 fractures. Her own weight was sufficient to break her legs, and she frequently had produced fractures by turning in bed. Not much inflammation or pain attended them and no pain preceded. Union was remarkably tedious, for when dressings were removed at the end of the second or third month the bone was still pliable, and angular bending would begin and continue until more than a year after the accident. Great deformity finally ensued.

XX. Blanchard (case of Frankenthal). (*Transac. Amer. Orthop. Assoc.*, 1895, viii. 275.) A woman of twenty-nine years, who commenced to have fractures in the second year of life. Up to the time when reported she had 17 fractures of the long bones and 2 dislocations. There was but slight pain or inflammation with the accidents. Union was very tedious. At the end of two or three months it was not firmer than rubber, and two or three years passed before it was completely firm. Dressings were usually removed after two or three months, and angular curvature then commenced and increased until the end of one or two years.

XXI. Blanchard (*ibid.*). A girl of four years fractured her right femur when two years old, by falling from a chair. It was neglected, and angular deformity resulted. About six months later she broke her left femur through a very slight fall, and again in six months broke it in another place. Union was prompt and perfect in the last two fractures.

XXII. Fleming (*Edinb. Med. Journ.*, 1862, viii. 24). A man of twenty-four years had his first fracture, the thigh, when eighteen months old, and since then had in all 53 fractures, viz., thighs 35, ribs 8, forearms 5, jaw 1, fingers 4. The simplest causes were sufficient. Union was remarkably prompt in the fracture under observation—the last one.

XXIII. Gibson (*Instit. and Pract. of Surgery*, 1850, 8th ed., vol. i. 234). A man of twenty-two years, previously of excellent health, had extraordinary brittleness of the bones from infancy, and had suffered in all 24 fractures from the slightest causes, such as tripping over a rug, walking, etc. Union was prompt and without much deformity.

XXIV. Velpeau (*Gaz. des Hôpitaux*, 1847, 2 ser., ix. 265). A girl of excellent general health had her first fracture at the age of fourteen months, and before the age of fifteen years had 6 fractures—thigh 5, arm 1. All resulted from very slight causes, twice while merely walking. The last fracture united slowly. She had also had 3 dislocations.

XXV. Earle (quoted by Stanley, *Diseases of the Bones*, 1849, 195). A boy of ten years had 8 fractures—6 in one tibia and 2 in one femur—each in a different part of the bone from the preceding ones. All united within the usual time.

XXVI. Mettauer (personal communication to Gibson, *Institutes and Practice of Surgery*, 1850, 8th ed., vol. i. 235). A man of seventy years had been subject to fractures from earliest infancy. The tendency to fracture had seemed to increase with age. The slightest cause was sufficient, such as mounting a horse, a sudden twist of the body, etc. Recovery was always astonishingly speedy.

XXVII. Corson (*The Clinic*, Cincinnati, 1873, iv. 157). A well-developed infant cried for five hours after a difficult birth. On the eleventh day a fracture of the thigh was discovered, and nine days later the other thigh was fractured, two days later still the humerus broke, and at this time callus was discovered on the radius and ulna.

XXVIII. Langton (*Brit. Med. Journ.*, 1895, ii. 1234). A girl had been by the age of eleven years the subject of several spontaneous fractures as the result of muscular action or very slight injury. All united but one, which had been roughly treated. In this one union was never firm. Subsequently two fractures which had been firm parted again, and in one of them a sarcoma developed by the age of twenty-three years.

XXIX. Houston (*Dublin Journ. Med. and Chem. Sciences*, 1836, viii. 474). A well-developed boy of five years had his first fracture at three years. Within two years he broke each tibia and each femur once. The cause was always inconsiderable, and the fractures always occurred while running. Union was always prompt.

XXX. Schultze (*Arch. f. klin. Chirurg.*, 1894, xlvii. 327). A girl, thirteen years old, was weak when born, but later grew well and strong. She had her first fracture, the right femur, at nine months. At one and a half years of age the same place broke again. Up to six years of age she had 5 more fractures without any trace of bending, and by her thirteenth year she had not less than 30, viz., right thigh 7, left thigh 5, right leg 6, left leg 4, right arm 2, left arm 4, right forearm 2. All were produced by the slightest causes. Pain was nearly absent in fractures of the upper extremity, but present in those of the lower. Union took place in a shorter time than in normal bone. Great bending and twisting of the lower extremities finally developed. Operation showed the tibiæ to be much flattened, and with the marrow-cavity of the right tibia scarcely visible and no trace of it in the left. The right tibia and fibula were united by a flattened exostosis.

XXXI. Linck (*Archiv f. Gynäkol.*, 1887, xxx. 264). No history of accident to or disease of the mother. Labor was easy. A premature child which died shortly after birth. There were fresh fractures and old healed and unhealed fractures of all the ribs—40 on the left side and 44 on the right—which had caused numerous nodules and bendings; 10 fractures of the extremities—6 of them fresh—and united and recent fractures of the clavicles. No enlargement of the epiphyses or of the junction of the ribs and cartilages was anywhere found. The microscopical examination showed the bones to be practically normal.

XXXII. Parker (*New York Med. Journ.*, 1852, n. s., ix. 96). A girl of eleven years, previously in poor health, had her first fracture—of the tibia—at the age of six years. Five months later she broke her right thigh, and when about ten years old her clavicle. The cause was always insignificant, and union was always prompt.

XXXIII. Howell (*Atlanta Med. and Surg. Journ.*, 1884, xxv. 82). A healthy man of twenty-eight years had his first fracture—the left thigh—in his second year, through falling from a chair. A few years later he broke the right thigh. By the age of twelve years he had broken his right thigh 3 times and his left thigh 2 times, and a year or two later he broke his left thigh again. The 7th fracture was of the right thigh in his sixteenth year, and the last fracture was of the left thigh at twenty-eight years. The last united slowly.

The following cases are even more briefly described by those reporting them than are some of the last:

XXXIV. Tamplin (*Lectures on the Nature and Treatment of Deformities*, 1846, 234). A girl of seventeen years, of unhealthy appearance and pallid, had about 40 fractures produced by walking or other slight cause. [The age when the disease began is not stated.]

XXXV. Dawson. According to Corson (*The Clinic*, Cincinnati, 1873, iv. 157), W. W. Dawson "presented at one of his clinics" a child of three years who had suffered more than a score of fractures. The readiness with which the bones united was one of the most prominent features.

XXXVI. Willett (*Brit. Med. Journ.*, 1895, ii. 1235) states that he remembered a child who had broken 6 of its long bones, only one of the fractures showing any signs of callus.

XXXVII. Ridd (*Schmidt's Jahrbücher*, Jahrg., 1868, Bd. ii. 631). [This is the reference given by Linck, but I have not succeeded in verifying it, and there seems to be some mistake in it.] A healthy mother had a premature child which lived nine days and died suddenly in a convulsion. The autopsy revealed 54 fractures, partly recent, partly united by callus.

XXXVIII. Ketch (*Trans. Amer. Orthop. Assoc.*, 1893, vi. 86) saw a child some years ago in a public clinic in New York who would have a fracture on turning in bed. [I have been unable to learn anything further about this case.]

XXXIX. Hoadley (*Trans. Amer. Orthop. Assoc.*, 1893, vi. 85) says that Bond showed a case of fragilitas twenty years ago in the Chicago Medical College. The child [sex not stated] was about twelve years old, and there had been about 119 fractures. The bones are said to have been soft in the earlier stages. The fractures united with great facility. [I have been unable to discover where the case was first reported.]

XL. D'Outrepont (*Abhandlungen u. Beiträge geburtshülflichen Inhalts.* Th. 1, Bamberg u. Würzburg, 1822, 228; quoted by Gurlt, *loc. cit.*, 225). A stillborn child exhibited signs of fracture of the right thigh, both upper arms, and the left clavicle. Callus, which seemed probably to be recently formed, was found on the bones at the autopsy.

XLI. D'Outrepont (*ibid.*, 233; quoted by Gurlt, *ibid.*, 225). A child, after an easy labor, was found to have fractures of the left femur, right humerus, right clavicle, and two ribs. No cause was discovered. The child recovered.

XLII. Wight (*Annals of Surgery*, 1893, xviii. 662). A boy of eighteen years had great deformity of the legs and thighs from angular union of fractures. The father stated that his son had always been subject to poor health, and that he had had fits, and that this was the cause of the crooked bones. [Apparently the deformity was the result of frequent fractures of the fragile bones caused by muscular action during the fits. The age when the convulsions began is not stated.]

D. ISOLATED CASES WITH SOME ELEMENT OF DOUBT.

The following instances of the disease, occurring in a single individual of a family, have some element of doubt attached to them as regards their belonging strictly to the class of idiopathic osteopsathyrosis. In some of them the writer mentions the existence of rickets, although it is not convincing in every instance that this disease had been present; for the old writers, and many more recent ones as well, were disposed to attribute all cases of early fragilitas to rickets as a matter of course. In other cases rickets certainly had existed at one time, but the fragilitas showed itself at a period when rickets must have ceased to be active. It does not seem at all clear that the two conditions were at all interdependent in these cases.

In other instances we have to do with cases which resembled in some particulars the so-called fœtal rickets, but in which there was a degree of fragility by no means corresponding with that usually seen in this condition. Finally, we have certain intrauterine cases where the fractured or membranous condition of the bones of the cranium, or the very great number of fractures occurring widespread in fœtal life, led to the suspicion that the cause may have been an insufficient advancement of the ossifying process. Such a condition is, however, a very obscure one, and does not satisfactorily explain the fragility. I have, therefore, provisionally included these cases with the others as instances of idiopathic osteopsathyrosis. Although there is a history of accident to the mother during pregnancy mentioned in some instances, it does not seem sufficient in the cases I have selected to account for the fractures.

XLIII. Jacquinelle (*Journ. de Médec., Chirurg., Pharm., etc.,* 1788, lxxvii. 267, and 1790, lxxxiv. 216). A man of thirty-two years undoubtedly had rickets severely as an infant, and could not walk until five years old. He was then fairly well until twelve years old, when he had his first fracture, one of the arm. He had a fracture of both thighs at fifteen years, and one of the arm two years later. In all he had 6 fractures. The degree of force required was inconsiderable. Union was prompt and complete.

XLIV. Lonsdale (*A Practical Treatise on Fractures,* 1838, 21). A girl in whom there had been 22 fractures from the most trivial causes. Most of the bones were rickety. Union took place in the usual time. [The age of the girl is not stated, nor is the evidence of rickets explained. From the context it appears that there was no bending of the bones in this case.]

XLV. Barwell (*Brit. Med. Journ.,* 1882, ii. 1155). A girl of seventeen years, with great bending and deformity of the bones of the extremities, but with no bending of the ribs nor enlargement of the epiphyses. Between the ages of nine and thirteen years she broke her arm 4 times and her ribs on several occasions. He describes the case as rhachitic osteomalacia, stating that it was neither rickets nor osteomalacia. [The late development and the absence of positive signs of rickets make it probable that this is an instance of idiopathic osteopsathyrosis.]

XLVI. Lange (Günsburg's *Zeitsch. f. klin. Medizin,* 1852, iii. 263). A girl of eleven years, of scrofulous habitus and with pigeon breast, had in all 6 fractures. Two years later she had her 7th fracture. [Nothing is said as to the age when the first fracture occurred, nor is there anything to suggest rickets unless it is the pigeon breast.]

XLVII. Esquirol (quoted by Malgaigne, *A Treatise on Fractures,* Amer. ed., 33) had in his collection the skeleton of a rhachitic female in which nearly all the long bones were broken, and more than 200 fractures could be counted. [Nothing is said of the age, but it is safe to presume that with such numerous fractures the disease must have been present in childhood, and that something more than rickets was present.]

XLVIII. Malgaigne (*A Treatise on Fractures,* Amer. ed., 33) says that in the Musée Dupuytren is a skeleton of a child, of six or seven years, with general rhachitis and with 12 fractures.

XLIX. Malgaigne (*ibid.,* 31). A boy of ten years, who had been badly rhachitic in early infancy and whose legs and arms were distorted by the disease. His first fracture occurred at the age of six years, and he had 4 by ten years. No special force was required. All healed well.

L. Chaussier (*Bull. de la Fac. de Méd. de Paris,* 1814, iii. 306). A female child, dying twenty-four hours after an easy labor. The long bones of the extremities were shorter and thicker than normal and more or less curved. There were found 113 complete fractures, some of them united, some still yielding to bending and with crepitation, and with the periosteum in these places much thickened. The ribs alone had 70 fractures.

LI. Barker (*Brit. Med. Journ.*, 1857, ii. 806, 823). A female child, dying ten minutes after birth, which had not been difficult. The mother had repeatedly had falls on a flight of stone steps. The examination of the child showed an entire absence of bone in the covering of the brain, and numerous fractures of both the upper and lower extremities. The bones were remarkably brittle, the merest pressure snapping the ribs like glass. Chemical examination of the bones showed too small a proportion of inorganic material—33.34 per cent. The writer believes that arrest of development did not account for the fragility, since the fractures were situated where ossification had advanced the most.

LII. Hirschfeld (*Gaz. des Hôpitaux*, 1857, 291). A seven months' male fœtus, born dead. The mother had had a fall. The fœtus showed no evidence of rickets. The vault of the skull seemed made only of minute thin plates of bone. The long bones of the extremities, the ribs, and the clavicles exhibited a number of fractures, certainly over 20.

LIII. Vrolik (*Tabulæ ad illustrandam embryogenesin hominis et mam malium*, 1849, Fol. Tab. 91, Fig. 1, 2; quoted by Linck, *loc. cit.*). A child which died three days after birth. The parents had been syphilitic, but the mother bore an entirely healthy child the next year. The skull was hydrocephalic, and, when skeletonized, was found to consist largely of a great number of irregular pieces of bone, suggesting Wormian bones. The extremities and the ribs exhibited numerous fractures, some fresh, some united by callus.

LIV. Dupuytren (*Bull. de la Fac. de Méd. de Paris*, 1811, ii. 154.) A little girl, very delicate, and with a weakly mother. At the age of two months she had her first fracture—the arm—without known cause, and two months later she broke the left thigh while lying down. At eight months of age she broke the right thigh. This last was preceded by a curvature of the limb. At two years and four months the right thigh appeared to be giving way, and after some days it broke as the result of a fall. Then the earlier of the old fractures softened and the bones became bent.

LV. Dubrueil (*Étude critique sur les fractures spontanées*, Paris, 1891). A boy of ten years, of a healthy father but rhachitic mother, had his legs bent in infancy by rhachitis. He suffered his first fracture—the humerus—at six years, and had 4 fractures by the age of ten years. The cause was slight in all; there was not much pain, and union was not delayed.

LVI. Cecconi (*Giornale dell. soc. med. chir. di Parma;* quoted in Hufeland's *Journ. der pract. Arzneyk*, 1816, xlii. St. 4, 124). A child dying seven hours after an easy birth. All the epiphyses had been broken "in the direction of their length." The shoulder-blades were the only ones spared. Crepitation could be heard and felt. No history of accident to the mother. [It is not clear from the description whether or not this is an instance of separation of epiphyses, but it would seem not. I have not been able to obtain the Italian original.]

LVII. Schroeder (*Medizin. Zeitung d. Verein f. Heilk. in Pr.*, 1843, 136). A girl of five years, of rhachitic constitution and the subject of a tapeworm, broke both thighs in an attack of convulsions. She had had the same accident three times in the two preceding years.

LVIII. Volckamer (*Miscellanea curiosa med.-phys.* Acad. N. C., Dec. 1. Ann. 2, 1671, Obs. 225, p. 327; quoted by Gurlt, *loc. cit.*, 230). A boy of ten years, the subject of epilepsy since three years old. A few months before death he broke his tibia and humerus in a violent convulsion, and shortly after this experienced more fractures. The autopsy showed still more fractures that had not been recognized.

In these last two cases the fractures were evidently the result of violent muscular contraction, but there must probably have existed fragility as well.

Chaussier (*loc. cit.*) quotes certain cases of intrauterine fractures cited by older writers which seem to be instances of remarkable fragility; but whether these were due to true osteopsathyrosis or to some lack of development cannot be surmised from this nature of the reports. Moreover, as he remarks, there is reason to doubt their existence, since the reports are founded largely upon hearsay. The cases are those of Malbranche, Hartzoeker, and Muys, as follows:

LIX. Malbranche (*Traité de la recherche de la vérité*, liv. 2, chap. 7). A young man, an imbecile, whose body was broken in the same places in which the bones of criminals are broken. He had lived more than twenty years in this state. Maternal impression, from seeing the punishment of criminals on the wheel, was assigned as the case.

LX. Hartzoeker (*suite des Conjectures Physiques*, Amsterdam, 1708). A woman who lived to the age of thirty-two or three years, always confined to bed, with her bones everywhere broken as in the case of criminals. Assigned to maternal impression, as in the last cause.

LXI. Muys (in the preface to *De musculorum artificiosa fabrica*, 1751). A child was born at term to a woman who had seen an execution upon the wheel. The child had all its members broken like those of a thief.

LXII. Notta (*Bull. Soc. Anat. de Paris*, 1849, xxiv. 83). A male child of a healthy mother. The head at birth was remarkably soft and could be compressed like a vessel of water. The child died soon after birth. The autopsy showed ossification but little advanced, and much of the bone of the skull made of numbers of small irregularly shaped pieces about 1 cm. in diameter, and separated from each other by membranous tissue. The bones of the trunk were normal. The tibiæ, femora, and bones of the left forearm were somewhat curved, and the ends of the radii swollen. The bones of the extremities presented 15 fractures, 12 of which were recent, 2 consolidated, and 1 uniting.

LXIII. Harvey (*Med. Herald*, St. Joseph, 1891, x. 255). A boy in whom at birth the whole vault of the cranium was nearly without support or protection. There were double bowleg and anterior curvature [which may have been the result of intrauterine fractures]. When three days old he broke the left arm, and by the age of two and a half months he had 8 fractures. Severe falls had accounted for some of them. [For the others the cause is not stated.] Crepitus was very evident in all fractures. The child grew well and looked well.

LXIV. Schmidt (*Monatssch. f. Geburtsk. u. Frauenkr.*, 1859, xiv. 426). A weakly child of healthy parents, died shortly after an easy birth. All the bones seemed to crepitate when the body was handled, and each seemed entirely broken in two or three places. The head felt like a broken egg. The autopsy showed the bones of the lower extremities three or four times broken; some of the fractures already united, some with slight callus, and some with none. The bones of the head were composed of numerous small bony plates. Microscopic examination by E. Wagner led to the conclusion that the condition was a congenital non-syphilitic atrophy of the entire skeleton, best described as a chronic parenchymatous osteitis; quite different from osteomalacia or rhachitis or the ordinary osteitis.

LXV. Baudelocque (case described by Marc in *Dict de Sci. Méd.*, 1816, xvi. 64). Labor was rapid and easy, and there had been no violence done to the child, which died a few days after birth. The autopsy showed 43 fractures of the long bones, including most of the ribs. Even some of the cranial bones were broken. Some of the fractures were consolidated and others were in process of union.

This is the same as a case reported by Chaussier (Proces verbal, etc. —see *loc. cit.*, 306).

LXVI. Amand (*Nouveau obs. sur. la. prat. des acc.*, p. 92, obs. viii. Quoted in *Dict. des Dict. de la Méd. Française et Étranger*, 1840, iii. 219). A fœtus of four or five months. The bones were separate and movable in the middle of the forearms, thighs, and legs, and seemed joined only by the skin.

LVII. Griffith (case now reported).

A short review of the affection based upon these reported cases is in place here.

Etiology. As the name idiopathic implies, we find that the histories of the cases collected throw little light upon the cause of the disease. The influence of *heredity* is the only point which strikes us forcibly, inasmuch as direct inheritance, or at least a family tendency, was shown in 18 of the 67 reports. This influence of inheritance is so marked that Gurlt has compared the affection to hæmophilia and Moreau to progressive muscular dystrophy. There is a distinct difference in the line of inheritance, the influence of the male greatly predominating. We notice, namely, that in the 11 families in which direct inheritance (from parent or grandparent) obtained the disease was transmitted in 7 instances from the father, and often from the grandfather as well, and that in 2 more instances, Heister's and Battle's, it descended through an unaffected mother from an affected grandfather. Of the 2 remaining families, in 1, Willard's, the disease appears to have been transmitted from the father, and was certainly so from one of his affected daughters to her children, while in the other, Goddard's, it was the mother who was subject to fractures. In Atherton's case, although the transmission was predominantly by the males, the grandmother as well as the grandfather was subject to fractures.

In the matter of the etiological influence of *sex*, the accounts are not sufficiently accurate to allow of any reliable figures being given, since in many cases the sex of the children is not stated. It is noticeable that of all the cases, young and old, occurring in the family connection of the 18 observations where inheritance or family tendency to the disease was marked—if we leave out the instances reported by Ekmann as too anomalous—at least 47 were males and but about 19 females, with 24 whose sex is not mentioned. This shows a tendency to a transmission not only through males but to males. Of the total number of cases developing in childhood here reported there are, as nearly as can be counted, 41 males and 32 females; but there are so many others whose sex is not stated that no conclusion can properly be drawn.

As to the *age*, there is a decided tendency for the affection to begin early in life. There are a number of cases reported which began later, yet the abstracts here given, although limited to the disease as seen in childhood, still contain a large proportion of the instances of idiopathic osteopsathyrosis reported for all periods of life. The list does not, of course, contain instances of the secondary forms, which include the atrophic fragilitas of old age. Details are not complete enough to allow of more than general statements, but we find that in many instances fractures occurred before birth, in still more they appeared a little later, and in a few the fragility developed only as growth advanced, notably in the cases of Pauli.

It is worthy of note that the amount of *force* required to produce fractures was nearly always very slight, and sometimes remarkably so. Among the causes mentioned are going upstairs, leaning over, turning around, being moved in bed, tripping, turning in bed, the slightest fall, and the like. In Blanchard's first case the mere weight of the body was sufficient to break the legs, and in my own case the thighs were fractured on one occasion by the child falling forward while in a sitting position.

The influence of *other diseases* in producing idiopathic osteopsathyrosis is problematical. In some cases the children have been weakly, but as a rule this was not the case. The influence of syphilis seems to have been practically negative in the cases I have collected. Were it otherwise they would not be included in the category of an idiopathic condition. The mere fact that a parent was, or was supposed to be, syphilitic is not sufficient to explain the strange fragility. I have, as stated already, excluded from this list those cases in which it seemed reasonable to believe that the tendency to fracture might be the result of the presence of multiple gummata of the bones. So, also, there seems to be no good reason to attribute a special fragility to the coexistence or previous existence of rickets. Rickets is an extremely common disease, yet fragilitas, such as the abstracts exemplify, is rare. Then, too, fragilitas so often appears at an age when rickets has not yet developed, or sometimes comes on when rickets has ceased to be active. It has been claimed that a previous rickets produces later a condition of fragilitas, but this is an assumption for which I have been unable to find any adequate proof.

PATHOLOGY AND PATHOLOGICAL ANATOMY. This is, if possible, even less understood than is its etiology. The relationship of osteopsathyrosis to osteomalacia and to rhachitis is a question which forces itself upon us. It is evident that the process differs entirely from osteomalacia. In this latter affection there is an increasing softness of bone with a remarkable tendency to bending and to absorption of inorganic material. Fractures, if they occur, are purely of a secondary nature, for the prime factor is the softening. The family reported by Ekmann is a pointed instance of a combination of osteomalacia and osteopsathyrosis, or, rather, of the appearance of the two diseases singly or combined in different members of the same family. It is not a proof of their unity.

Rhachitis is much more closely allied to osteomalacia than to osteopsathyrosis. There is in children a natural tendency to infraction of bone—*i. e.*, to the occurrence of green-stick fractures; and in rhachitis this tendency is greatly exaggerated. In osteopsathyrosis, on the other hand, just the reverse of this is seen, and the condition is one of extreme brittleness without disposition to bend. Rhachitis, as has already been pointed out, sometimes causes true fractures, but far oftener does not. When, therefore, we find an excessive degree of fragility in a case of rickets it is rather an evidence that rickets and osteopsathyrosis may be combined in the same individual—not a proof that they are at all identical or even necessarily related. It must, too, be borne in mind constantly that in many cases in which curvature of the limbs is spoken of the condition may very possibly have been the result of fracture and not of bending.

Cases of so-called fœtal rickets have repeatedly been described. The pathological position of this condition is not certain. Orth (*Path. Anat. Diagnost.*, 1894, 681) claims that it has nothing whatever to do with rickets. Some of the reported cases exhibit a remarkable softness of the skull, with great fragility of the bones of the extremities, yet without any of the characteristic symptoms of rickets. Cases of this nature I have provisionally placed in the category of osteopsathyrosis, since they seem to belong there better than elsewhere.

But few chemical and microscopical examinations of the bones have been possible, and these have made the matter but little clearer. In the case reported by Linck the microscopical examination showed that the calcification of the projecting portions (the callus) at the seat of fracture was not perfectly developed, but that the bone elsewhere was normal. In Schultze's case excised pieces of tibia showed the marrow cavity nearly obliterated in the right leg and quite so in the left. But as this was at the seat of former fracture, it taught little. The bones in Barker's case, which is one of the possible instances of imperfect ossification, gave on chemical analysis 33.34 per cent. of inorganic matter, and 66.66 per cent. of organic matter, thus showing a great deficiency in the amount of the former. On the other hand, in a typical case of idiopathic osteopsathyrosis occurring in an adult and reported by Enderlen (*Archiv f. path. Anat.*, 1893, cxxxi. 223) there was in the portion of femur examined an excess of organic material of only 6.27 per cent.—a figure wholly inconsiderable. Finally, in the case of Schmidt, which was one of the doubtful cases similar to that of Barker, the microscopical examination indicated the presence of a chronic parenchymatous osteitis, which Wagner called a " non-syphilitic atrophy." These are all the examinations which have been made among the cases collected here. As may be noticed, they are contradictory; and, if we leave out the doubtful cases and take only the more typical ones of Linck and Schultze, and the adult case of Enderlen, we find no change present which accounts in the slightest degree for the fragility.

Gurlt suggests that a certain compactness in the bone, rather than any alteration in the chemical composition, explains the fragility, and Ziegler, as quoted by Schultze, suggests some pathological alteration of the basis of the bony framework. Moreau believes that there is some nervous basis for the disease, and that a lesion of the anterior horns of the spinal cord is the most probable cause.

Verneuil (Virchow-Hirsch, *Jahresbericht, etc.*, 1885, ii. 317) examined the urine in three cases of spontaneous fracture, and found it remarkably rich in phosphatic salts, and Blanchard reported a large amount of earthy phosphates in the urine of his first patient. It is possible that this may have some bearing upon the pathology of the disease, but further studies are needed.

An interesting feature of the affection is that in nearly all cases union of the broken bones was prompt, and generally remarkably so. Sometimes the fragments united so readily that, as in Mettauer's case and in the one which I had under observation, professional advice was not even sought for. This rapidity of union has been pointed out by many writers. The most noteworthy exceptions which I have discovered were Blanchard's first and second cases, where union was extremely tedious. Some of the fractures in Velpeau's, Hamilton's, Howell's, and one of Greenish's cases united slowly, and some remained ununited in the cases of Langton, Hamilton, and possibly Willett.

With regard, again, to the cases of very numerous intrauterine fractures, and especially those with soft and crepitating cranii, for whose origin the assumption of an imperfect ossification has been made, it is to be remarked that autopsies show some of the fractures already united and some with callus present. This seems to indicate that actual fractures had taken place, and not that we had to do merely with numerous small separate centres of ossification which had not yet run together.

SYMPTOMS. The symptoms consist, of course, in the occurrence of numerous fractures from insignificant causes. As a rule, the accidents are painful as in fractures in any other condition. In a few cases, however, it is stated that pain was slight. This was noticed, for instance, in the reports by Battles, Jones, Schultze, Dubrueil, and Blanchard (first and second cases). Pain preceding a break, such as may occur in osteomalacia, is entirely foreign to osteopsathyrosis. As to the bones most frequently affected, it is noticeable that the long bones of the extremities, as well as the clavicles and ribs, are those oftenest broken, and that fractures are especially frequent in the lower extremities. This last is doubtless due merely to the greater strain put upon them. In no case is a fracture of a vertebra or of the pelvis distinctly mentioned, although possibly present in some of the cases of very numerous intrauterine fractures. The position of fracture is entirely independent of the relation of diaphysis and epiphysis. In very few instances was there even the supposition that the condition might consist in the separation of the epiphysis.

When refracture occurred it sometimes happened, as, for instance, in the patients of Willard and Schultze, that the seat of old fractures was the position of new ones. But oftener the bones seem to have broken irrespective of the position of former injury, and in the cases of at least two observers, Earle and Pauli, it is expressly stated that the seat of the old accident did not again fracture. In a few instances, as in the cases of Dupuytren and Langton, actual softening and yielding of the old callus previous to a new break seem to have taken place, but this was quite exceptional and anomalous, and must rather be called a complication than a symptom of the disease.

Diagnosis. In making a diagnosis we have first to determine the absence of other conditions to which the fragility may be secondary. The exclusion of syphilis and of nervous diseases is of importance. Rhachitis presents so many features apart from the breaking of bones that the diagnosis of this disease offers, as a rule, no difficulty. It is questionable whether true osteomalacia ever occurs at a very early age. It has, it is true, been described, as for instance, by Rehn (*Jahrbuch f. Kinderh.*, 1877, xii. 100), but Senator (Ziemssen's *Handbuch der spec. Path. u. Therap.*, 1875, xiii. I. 95) denies the existence of the disease in infancy; and it seems probable that Ziegler (*Lehrbuch d. path. Anat.*, 5 Aufl., ii. 123) is right in considering the reported cases to be really instances of rickets. At the least it can be said that osteomalacia would resemble rickets much more closely than it would osteopsathyrosis.

The absence of local lesions, such as osteitis, caries, tuberculous disease of bone, tumors of bone, etc., is also to be determined.

Prognosis. The prognosis is, as a rule, very unfavorable. The duration of life does not seem to be materially affected by the disease, but the tendency to fracture, once established, is apt to continue unabated. In Mettauer's patient it seemed even to increase with years. The amount of crippling in bad cases may be very extreme. This was the condition, for instance, in Blanchard's first patient. We may, however, always base a hope of improvement on the fact that a certain number of cases have distinctly outgrown the disposition to fracture. This was notably so in the cases of Axmann and of Graham, where the fragility disappeared by maturity. Some of the children reported by Willard also outgrew the tendency to fracture.

TREATMENT. In such a disease as this, in which both the cause and the nature are so little known, it is evident that the treatment can be but experimental. The administration of alteratives of various sorts, the maintenance of the best general health, and the protection of the limbs against fractures are the indications most apparent, with the hope that as time passes the fragility may be outgrown. Still, while guarding against injury, we must at the same time see that the muscles do not waste. It is likely that a proper lack of muscular support to the limbs may itself increase the tendency to fracture. It is important in case of fracture to secure union of the fragments in proper position, in order to prevent malposition as far as possible. A number of cases have thus reached adult life with but little deformity; while others have grown badly misshapen for want of proper care.

THE TREATMENT OF FRACTURE OF THE CLAVICLE BY INCISION AND SUTURE.

BY GEORGE W. SPENCER, M.D.,
DEMONSTRATOR OF SURGERY, JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

THE clavicle is more frequently broken than any other bone in the body, the radius, perhaps, excepted. The outer portion of the middle third is by far the most common seat of fracture, because this is the smallest and most sharply curved part of the bone, and must therefore yield to violence more readily than any other portion.

Hamilton (*Fractures and Dislocations*, sixth edition, p. 195) writes that of 157 fractures of this bone, exclusive of gunshot-fractures, 127 were in the middle third, and, excluding the partial fractures, the break was always near the outer end of the middle third; 4 were in the inner third, 17 were in the outer third.

Of 140 cases treated in the New York Hospital (Lent, *New York Journal of Medicine*, vol. 2, p. 159), 3 were near the sternal end, 4 at the junction of the inner and middle thirds, 43 in the middle third, 67 at the junction of the middle and outer thirds, and 23 near the acromial end. Of the 61 cases observed by Hurel ("Les Fractures de la clavicule," *Thèse de Paris*, 1857, p. 48), 44 were of the middle third, and